



Biology - 9700

■ 100 Questions

Topics Covered :

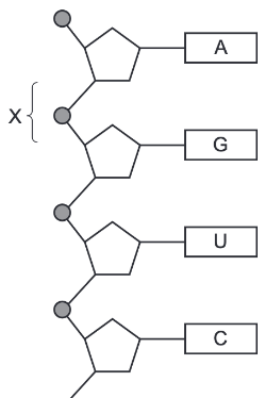
- ✓ 6.1 - Structure of nucleic acids and replication of DNA
- ✓ 6.2 - Protein synthesis

Join Us for more resources
or visit [bestgradez.com](https://www.bestgradez.com)



Question No 1 - (9700_w24_13_21)

The diagram shows part of a nucleic acid molecule.



What is the name of bond X?

- A glycosidic bond
- B hydrogen bond
- C peptide bond
- D phosphodiester bond

Question No 2 - (9700_w24_13_22)

XNA is a laboratory-made nucleic acid. XNA is made of nucleotides in which one component has been replaced by chemical X. The chemical X is organic but is **not** found in nature. The part of the molecule responsible for coding is **not** changed.

Which component of a DNA or RNA nucleotide has been replaced by the organic chemical X?

- A five-carbon sugar
- B phosphate group
- C purine base
- D pyrimidine base

Question No 3 - (9700_w24_13_23)

Which strand of DNA does RNA polymerase bind to?

- A** lagging strand
- B** leading strand
- C** non-transcribed strand
- D** template strand

Question No 4 - (9700_w24_13_24)

Which processes occur during the formation of messenger RNA?

- 1 condensation
- 2 polymerisation
- 3 replication
- 4 transcription

- A** 1, 2 and 3 **B** 1, 2 and 4 **C** 1, 3 and 4 **D** 2, 3 and 4

Question No 5 - (9700_w24_13_25)

The anticodon for the amino acid tryptophan is ACC.

What shows a template DNA sequence that includes the DNA triplet for tryptophan?

- A** UGG CGU CCG
- B** GCU GAC ACG
- C** CTT TGG ATG
- D** CCT ACC CAT

Question No 6 - (9700_w24_12_22)

A polypeptide molecule contains the amino acid sequence:

glycine – leucine – lysine – valine.

The table shows DNA triplets for these amino acids.

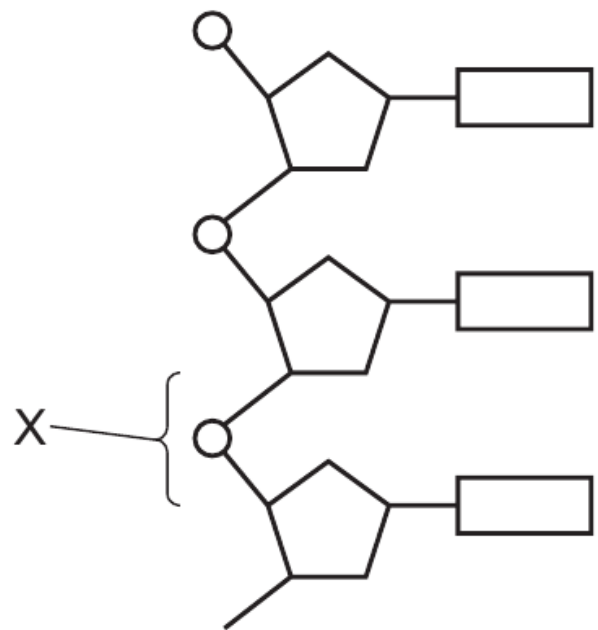
glycine	leucine	lysine	valine
CCC	GAA	TTT	CAA

Which tRNA anticodons are needed for the synthesis of this polypeptide?

- A** CCC GAA TTT CAA
- B** CCC GAA UUU CAA
- C** GGG CUU AAA GUU
- D** GGG CUU UUU GUU

Question No 7 - (9700_w24_12_23)

The diagram shows a section of a strand of DNA.



Which type of bond is labelled X?

- A** glycosidic
- B** hydrogen
- C** peptide
- D** phosphodiester

Question No 8 - (9700_w24_12_24)

Which row correctly describes cytosine?

	ring structure	number of hydrogen bonds it forms with its complementary base	type of base
A	double	three	purine
B	double	two	pyrimidine
C	single	three	pyrimidine
D	single	two	purine

Question No 9 - (9700_w24_12_25)

During the production of protein molecules, only one strand from the DNA double helix is used.

Which name is given to the DNA strand that is used to produce a new protein?

- A** non-transcribed strand
- B** leading strand
- C** template strand
- D** lagging strand

Question No 10 - (9700_w24_11_2)

Which statement explains why lymphocytes with **no** nucleoli die?

- A** The cells do **not** have centrioles and cannot divide.
- B** The cells do **not** have mitochondria and cannot release energy.
- C** The cells do **not** have mRNA and cannot transcribe DNA.
- D** The cells do **not** have ribosomes and cannot synthesise protein.

Question No 11 - (9700_w24_11_23)

Which statements describe how a gene mutation can lead to the production of a non-functional protein?

- 1 During transcription, an incorrect nucleotide is added to a DNA molecule.
- 2 The mutated gene results in a new codon being transcribed.
- 3 The order of the bases in an anticodon on tRNA is altered during translation.

- A** 1, 2 and 3 **B** 1 and 2 only **C** 2 and 3 only **D** 2 only

Question No 12 - (9700_w24_11_25)

The diagram shows the nucleotide sequence of a small section of the transcribed strand of a gene.

GCG CGC GGC GCG

The table shows the amino acids coded for by 10 mRNA codons.

mRNA codon	amino acid
AAG	Lys
ACG	Thr
CGG CGC CGU	Arg
CCG	Pro
GCC GCG	Ala
GGC	Gly
UGC	Cys

What is the sequence of the four amino acids in the polypeptide translated from this small section of a gene?

- A** Ala-Ala-Cys-Ala
- B** Ala-Arg-Gly-Ala
- C** Arg-Ala-Pro-Arg
- D** Arg-Arg-Thr-Arg

Question No 13 - (9700_w24_11_26)

How many hydrogen bonds form when adenine and cytosine each bind to their complementary bases?

	adenine	cytosine
A	2	2
B	2	3
C	3	2
D	3	3

Question No 14 - (9700_w24_11_4)

Which cell structures contain nucleic acids?

- 1 chloroplasts
- 2 Golgi bodies
- 3 lysosomes
- 4 ribosomes

A 1, 2 and 3 **B** 1, 2 and 4 **C** 1 and 4 only **D** 2, 3 and 4

Question No 15 - (9700_w24_11_5)

The statements describe processes that take place in a secretory cell.

- 1 Modification of the protein occurs in the Golgi body.
- 2 mRNA leaves the nucleus.
- 3 Ribosomes bind to mRNA during translation.
- 4 Transcription of a specific DNA sequence occurs.
- 5 Vesicles fuse with the cell surface membrane.
- 6 Vesicles transport the protein to the Golgi body.

Statement 4 is the first process, and statement 5 is the last process.

What is the correct sequence of the middle four processes?

- A** 2 → 3 → 1 → 6
- B** 2 → 3 → 6 → 1
- C** 3 → 2 → 1 → 6
- D** 3 → 2 → 6 → 1

Question No 16 - (9700_m16_12_19)

What does the enzyme DNA polymerase synthesise in a cell?

- A** a polypeptide using DNA as a template
- B** a strand of DNA using a polypeptide as a template
- C** a strand of DNA using DNA as a template
- D** a strand of mRNA using DNA as a template

Question No 17 - (9700_m16_12_20)

21.2% of the bases in a molecule of DNA are cytosine.

What percentage would be adenine?

- A** 21.2% **B** 28.8% **C** 42.4% **D** 57.6%

Question No 18 - (9700_m16_12_21)

One gene provides the code for the production of which type of molecule?

- A** amino acid
- B** DNA
- C** nucleotide
- D** polypeptide

Question No 19 - (9700_s24_13_19)

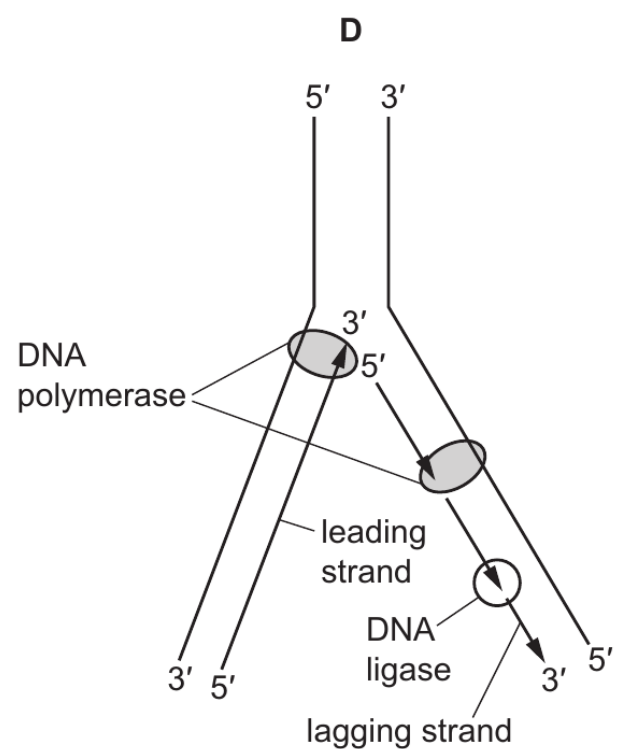
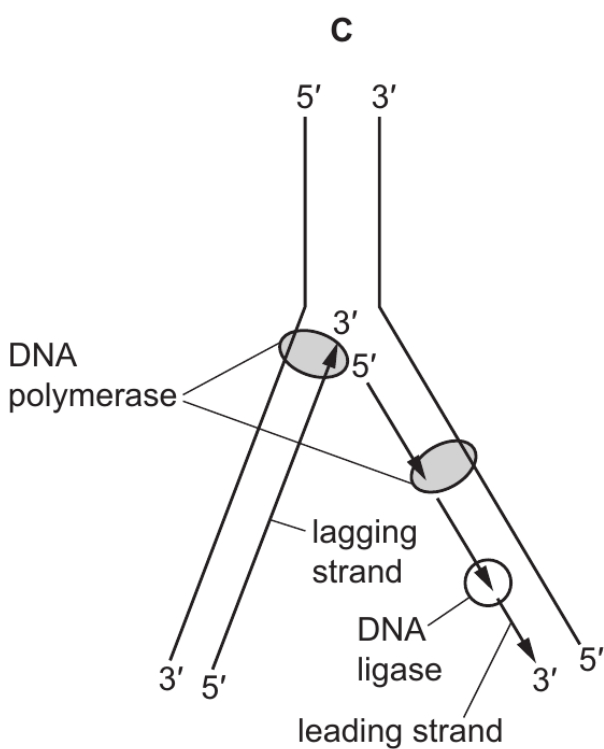
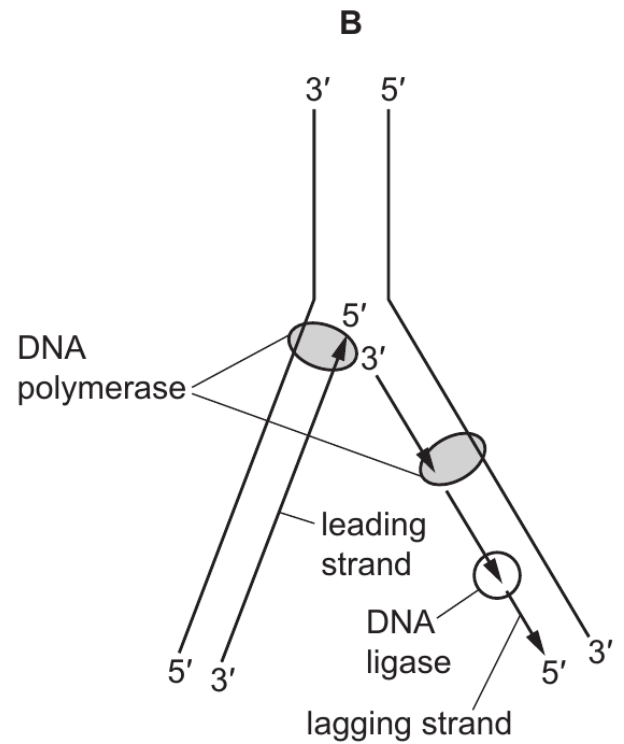
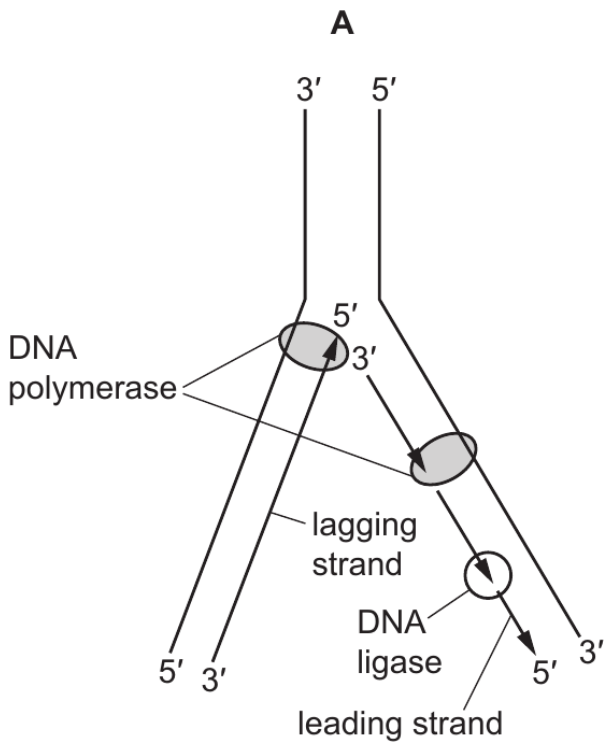
Which statements about the cell cycle are correct?

- 1 The cell cycle includes interphase and mitosis.
- 2 DNA replication takes place in interphase.
- 3 A cell can remain in interphase for several months.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Question No 20 - (9700_s24_13_21)

During the semi-conservative replication of DNA, the double helix is unwound by an enzyme. Which diagram shows how the strands are copied?



Question No 21 - (9700_s24_13_22)

A transcription error results in the deletion of one nucleotide from the middle of a primary transcript. mRNA forms from the primary transcript.

Which statement describes one possible effect of this deletion on the protein translated from this mRNA?

- A** The protein will be unchanged as the same amino acids can be coded by another codon formed by the deletion.
- B** The tertiary structure of the protein is **not** affected as only one amino acid has been changed by the deletion.
- C** Only one amino acid has been changed by the deletion but this changes the quaternary structure of the protein.
- D** The sequence of amino acids in the protein will be different as all the codons from the deletion onwards are changed.

Question No 22 - (9700_s24_13_23)

Which statements correctly describe the process of translation?

- 1 The nucleotide sequence on an mRNA molecule is used to produce a specific amino acid chain.
- 2 A section of DNA is copied into an mRNA molecule by RNA polymerase.
- 3 A polypeptide is produced because anticodons on tRNA molecules attach to mRNA codons through peptide bonds.

- A** 1 and 2 **B** 1 and 3 **C** 1 only **D** 2 and 3

Question No 23 - (9700_s24_13_24)

A molecule of mRNA was used in translation. Part of its sequence is shown.

GAU CUG UAA CGG

There were no introns present in the section of DNA that was transcribed to make this mRNA.

What is the sequence of the **non-transcribed** DNA strand for this section?

- A** CTA GAC ATT GCC
- B** CUA GAC AUU GCC
- C** GAT CTG TAA CGG
- D** GAU CUG UAA CGG

Question No 24 - (9700_s24_12_21)

The mRNA codons ACU, ACC, ACA and ACG all code for the same amino acid, threonine.

Which anticodons could specify an amino acid other than threonine?

- 1 UCA
- 2 ACC
- 3 UGU
- 4 UGC

- A** 1, 3 and 4
- B** 1 and 2
- C** 2 and 3
- D** 3 and 4 only

Question No 25 - (9700_s24_12_22)

Which bond formation does DNA polymerase catalyse?

- A** hydrogen bonds between bases
- B** hydrogen bonds between nucleotides
- C** phosphodiester bonds between bases
- D** phosphodiester bonds between nucleotides

Question No 26 - (9700_s24_12_23)

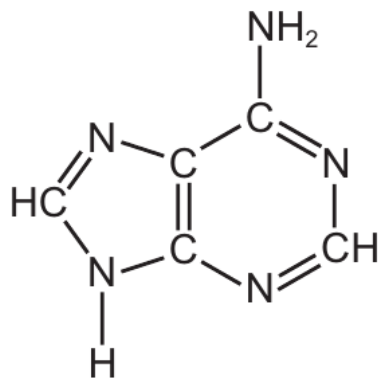
In eukaryotes, the RNA molecules formed during transcription are modified by the removal of non-coding sequences. This is followed by the joining together of coding sequences to form mRNA.

What are the coding sequences also called?

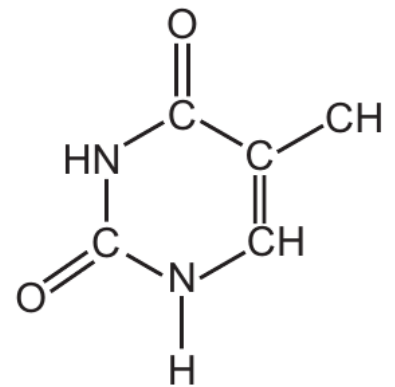
- A** codons
- B** exons
- C** introns
- D** primary transcripts

Question No 27 - (9700_s24_11_21)

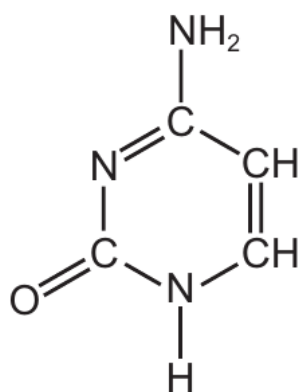
The diagrams show the chemical structure of four bases.



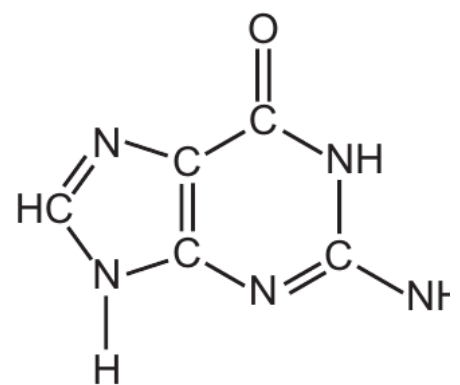
1



2



3



4

Which diagrams show thymine and cytosine?

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

Question No 28 - (9700_s24_11_22)

The diagram shows the nucleotide sequence of a small section of the transcribed strand of a gene.

CGG GCC CCG CGG

The table shows the amino acids coded for by 10 mRNA codons.

mRNA codon	amino acid
AAG	Lys
ACG	Thr
CGG CGC CGU	Arg
CCG	Pro
GCC GCG	Ala
GGC	Gly
UGC	Cys

What is the sequence of the four amino acids in the polypeptide translated from this small section of a gene?

- A** Ala-Ala-Cys-Ala
- B** Ala-Arg-Gly-Ala
- C** Arg-Ala-Pro-Arg
- D** Arg-Arg-Thr-Arg

Question No 29 - (9700_s24_11_23)

What does the process of translation require?

- A** DNA, free nucleotide bases and mRNA
- B** DNA, mRNA, amino acids and RNA polymerase
- C** mRNA, ribosomes and RNA polymerase
- D** mRNA, ribosomes, amino acids and tRNA

Question No 30 - (9700_m24_12_23)

Which statements are correct for **all** nucleotides?

- 1 The nitrogen-containing base is always attached to carbon atom 1 of the pentose.
- 2 The phosphate group is always attached to carbon atom 5 of the pentose.
- 3 A condensation reaction occurs to join the nitrogen-containing base to the pentose.
- 4 Nucleotides are linked together by condensation reactions between phosphate groups.

A 1, 2 and 3 **B** 1 and 2 only **C** 1, 3 and 4 **D** 2, 3 and 4

Question No 31 - (9700_m24_12_24)

How many phosphodiester bonds are present in a circular DNA molecule of 2700 base pairs?

A 2699 **B** 2700 **C** 5398 **D** 5400

Question No 32 - (9700_m24_12_25)

Which statements about complementary base pairing are correct?

- 1 Purines and pyrimidines are different sizes.
- 2 Complementary base pairing occurs during translation.
- 3 The base pairs are of different lengths.
- 4 Uracil forms two hydrogen bonds with adenine.

A 1, 2 and 3 **B** 1, 2 and 4 **C** 1, 3 and 4 **D** 2, 3 and 4

Question No 33 - (9700_m24_12_26)

During the mitotic cell cycle, the chromosomal DNA is replicated. The specific points in DNA molecules where replication is occurring are known as replication forks.

A typical human chromosome has about 150 million base pairs of DNA. It takes about 1 hour to replicate the DNA of a typical human chromosome.

The rate of replication using a single replication fork is approximately 50 base pairs per second.

Approximately how many replication forks must occur in a typical human chromosome during DNA replication?

- A** 835 **B** 41 700 **C** 50 000 **D** 3 000 000

Question No 34 - (9700_m24_12_27)

Which molecule has its synthesis directly controlled by DNA?

- A** amylase
B cholesterol
C glycogen
D phospholipid

Question No 35 - (9700_w23_13_22)

During lagging strand replication, short fragments of DNA are produced. The fragments are joined together by DNA ligase.

Which row correctly describes the structure of these short fragments of DNA?

	have base sequences that are complementary to the newly synthesised leading DNA strand	consists of one polynucleotide strand	contains only carbon, hydrogen, oxygen and nitrogen
A	x	x	✓
B	x	✓	x
C	✓	x	✓
D	✓	✓	x

key

✓ = correct

x = not correct

Question No 36 - (9700_w23_13_23)

The genome of the bacterium *Escherichia coli* has been altered to enable it to code for an amino acid that is not found in nature. All the ATC DNA stop triplets on the strand of DNA that is transcribed have been substituted to ATT. The ATC triplet can then be inserted to code for the new amino acid. A new tRNA can then be constructed to carry the new amino acid.

What is the anticodon of this new tRNA?

- A** ATC **B** AUC **C** TAG **D** UAG

Question No 37 - (9700_w23_13_24)

40% of the bases in a section of a non-transcribed strand of DNA are purine molecules.

What will be the total percentage of cytosine **and** uracil bases in the primary transcript that is transcribed from the other strand of the DNA?

- A** 20% **B** 30% **C** 40% **D** 60%

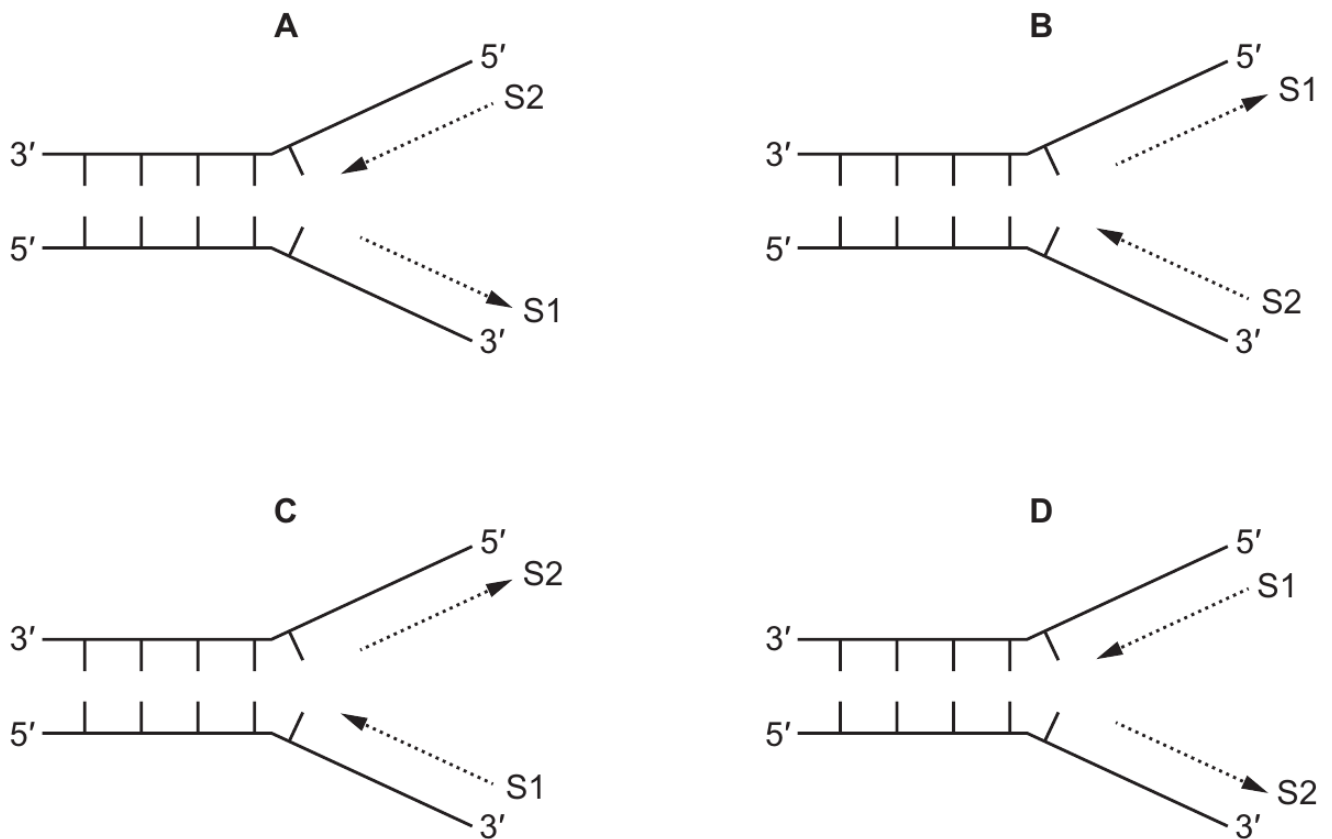
Question No 38 - (9700_w23_12_21)

Which statement correctly describes a feature of a DNA molecule?

- A** It has two parallel strands twisted into a double helix.
- B** It has complementary bases all held together by three hydrogen bonds.
- C** It has phosphodiester bonds that are formed using DNA ligase.
- D** It has a backbone of phosphate molecules and nucleotides.

Question No 39 - (9700_w23_12_22)

Which diagram correctly shows the replication of DNA?



key

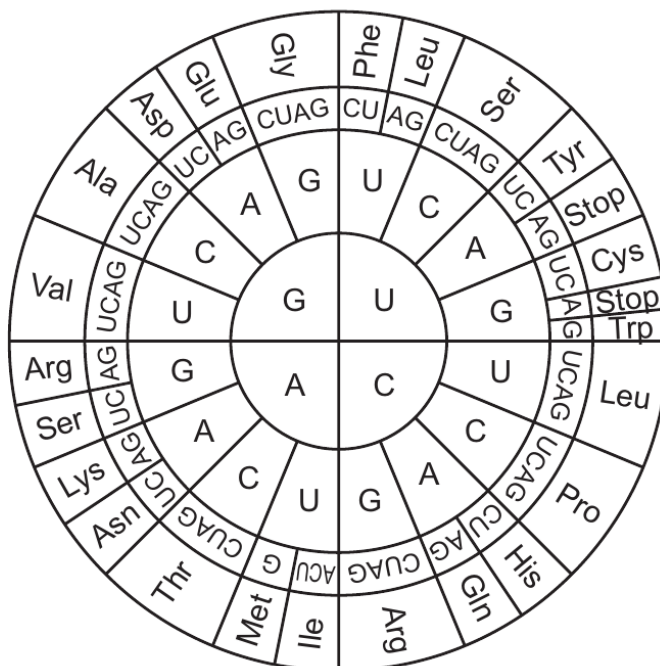
.....→ direction of replication

S1 leading strand

S2 lagging strand

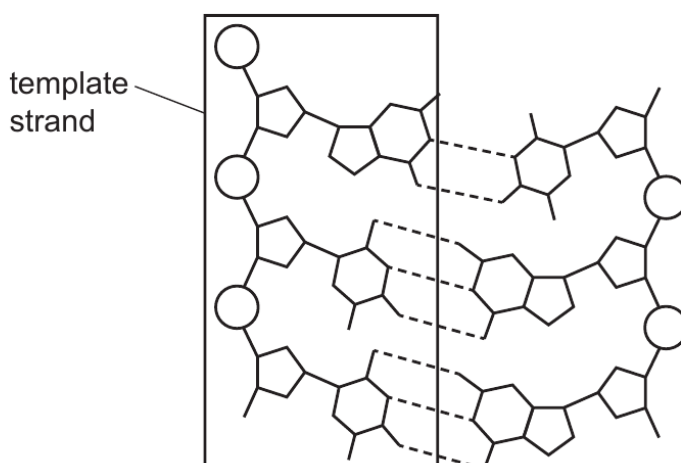
Question No 40 - (9700_w23_12_23)

The RNA codon wheel is a tool used to find which amino acid would be translated from an mRNA sequence.



Codon position 1 is in the centre of the wheel, codon position 2 is in the middle of the wheel and codon position 3 is near the edge of the wheel. The three letters on the outside edge of the wheel identify the amino acid.

The diagram shows a section of DNA coding for one amino acid. The template strand is outlined in a box and the DNA base sequence is read in the 5' to 3' direction.



Which amino acid is coded for by this section of DNA?

- A** Gly **B** Pro **C** Trp **D** Thr

Question No 41 - (9700_w23_11_20)

The statements are about genes and proteins involved in breast cancer.

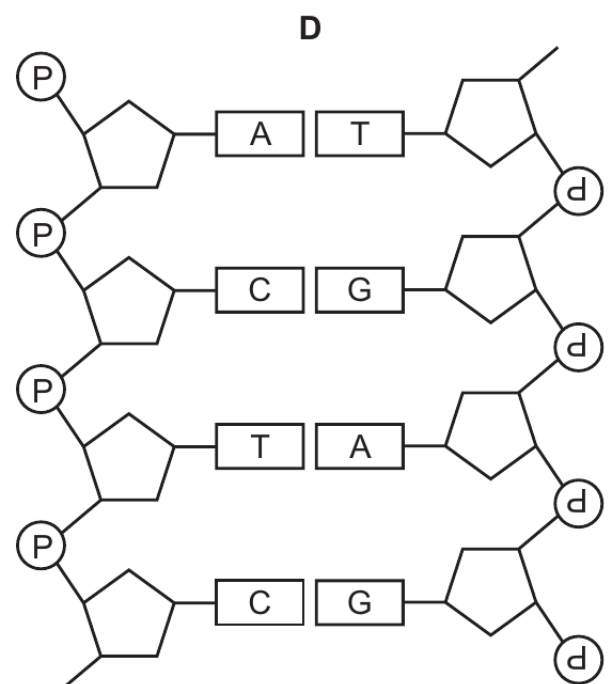
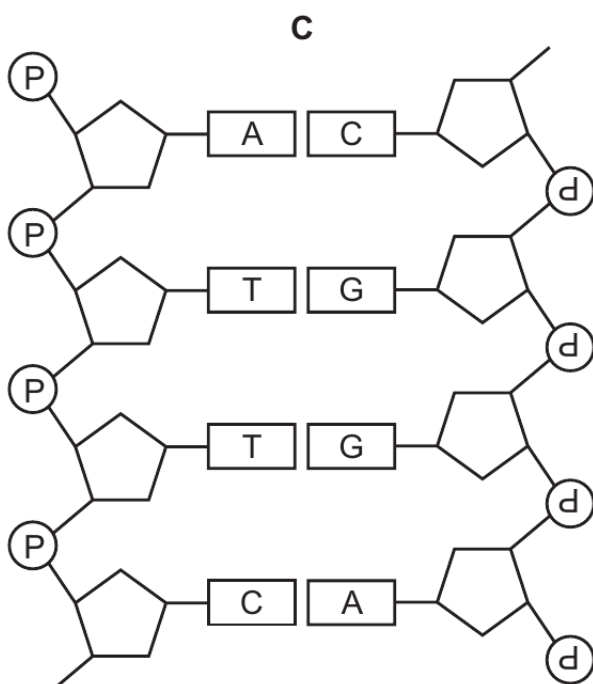
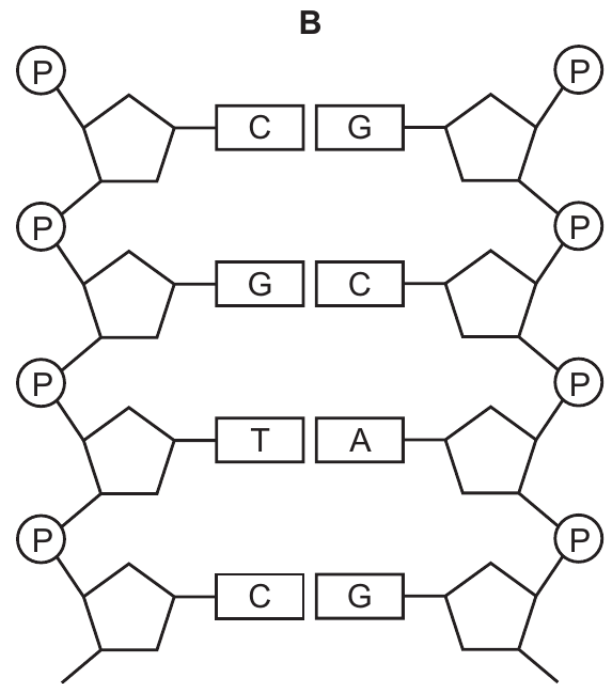
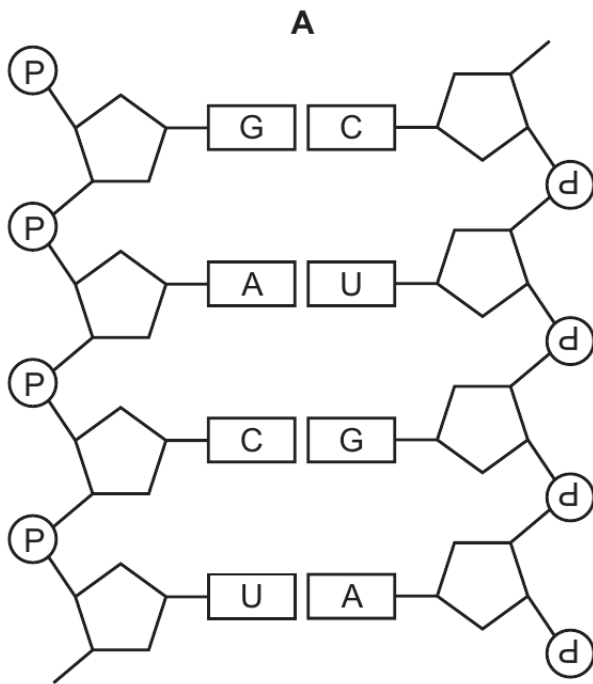
- The protein coded by the *BRAC1* gene inhibits the growth of breast cancer cells.
- The protein coded by the *p53* gene suppresses tumours.

Which combination of genes is **most likely** to result in breast cancer?

	<i>BRAC1</i>	<i>p53</i>	
A	<i>x</i>	<i>x</i>	key
B	<i>x</i>	✓	✓ = normal active gene
C	✓	<i>x</i>	<i>x</i> = mutated gene
D	✓	✓	

Question No 42 - (9700_w23_11_22)

Which diagram correctly shows the structure of a piece of DNA?



Question No 43 - (9700_w23_11_23)

Bacteria were grown in a medium containing ^{15}N . After several generations, all of the bacterial DNA contained ^{15}N . Some of these bacteria were transferred to a medium containing the common isotope of nitrogen, ^{14}N . The bacteria were allowed to divide once. The DNA of some of these bacteria was extracted and analysed. This DNA was all hybrid DNA containing equal amounts of ^{14}N and ^{15}N .

The remaining bacteria were left in the medium with ^{14}N and allowed to divide one more time. The DNA of some of these bacteria was extracted and analysed.

What is the percentage of hybrid DNA?

- A** 25% hybrid DNA
- B** 50% hybrid DNA
- C** 75% hybrid DNA
- D** 100% hybrid DNA

Question No 44 - (9700_w23_11_24)

Which statements correctly describe the process of transcription?

- 1 mRNA is decoded by a ribosome to produce a specific amino acid chain.
- 2 A section of DNA is converted to RNA by RNA polymerase.
- 3 tRNA transfers amino acids to the ribosome.

- A** 1 and 3 **B** 1 only **C** 2 and 3 **D** 2 only

Question No 45 - (9700_w23_11_25)

Sickle cell anaemia is caused by a mutation in an allele of the gene that codes for the β -globin polypeptide of haemoglobin.

The diagram shows the sequence of bases in a small section of the template strand of DNA for both the Hb^A (normal) and Hb^S (sickle cell) β -globin alleles.

Hb^A CTGACTCCTGAGGAGAAGTCT

Hb^S CTGACTCCTGTGGAGAAGTCT

Both the polypeptides for Hb^A and Hb^S are the same length.

How will the mutation in the allele result in the production of an altered version of the β -globin polypeptide?

- A** A tRNA molecule with the anticodon GUG will form hydrogen bonds with the altered codon on mRNA.
- B** All the amino acids coded for after the mutation will differ from those in the Hb^A protein.
- C** mRNA transcribed from the Hb^S allele will contain the codon CAC instead of the codon CTC.
- D** The ribosome will be unable to continue translation of the Hb^S mRNA after the altered codon.

Question No 46 - (9700_s23_13_23)

Which molecules make up the structure of ATP?

- 1 adenine
- 2 thymine
- 3 deoxyribose
- 4 phosphate
- 5 ribose

- A** 1, 2 and 3 **B** 1, 3 and 4 **C** 1, 4 and 5 **D** 2, 4 and 5

Question No 47 - (9700_s23_13_24)

A short piece of DNA, 19 base pairs long, was analysed to find the number of nucleotide bases in each of the polynucleotide strands. Some of the results are shown.

	number of nucleotide bases			
	A	C	G	T
strand 1				4
strand 2		7		5

How many cytosines were in strand 1?

- A** 2 **B** 3 **C** 5 **D** 7

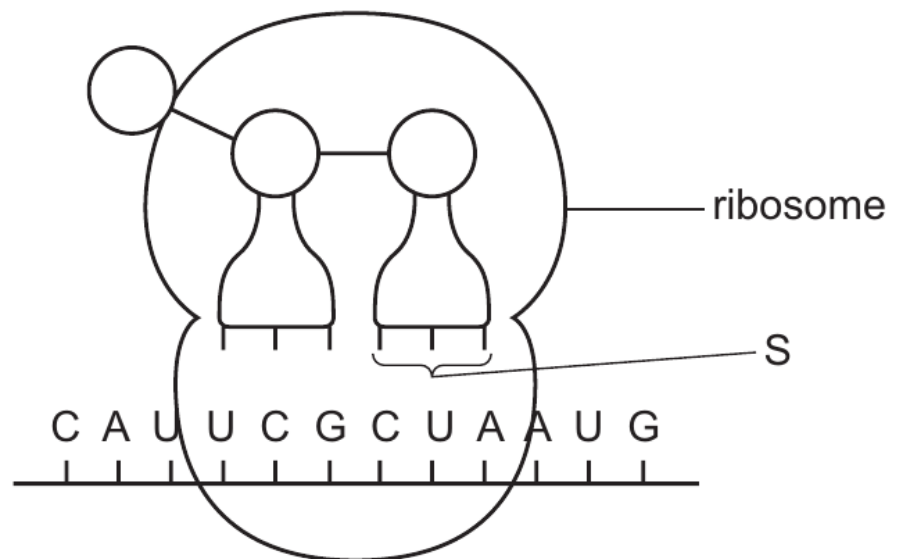
Question No 48 - (9700_s23_13_25)

Which statement about the role of DNA polymerase in the process of semi-conservative replication of DNA is correct?

- A** DNA polymerase forms the hydrogen bonds between complementary base pairs.
B DNA polymerase moves along the lagging strand in the 3' to 5' direction.
C DNA polymerase joins new bases to the leading strand only.
D DNA polymerase moves along leading and lagging strands in the 5' to 3' direction.

Question No 49 - (9700_s23_13_26)

The diagram shows the process of translation occurring at a ribosome.



What is the base sequence at S?

- A** CUA **B** CAT **C** GAU **D** GAT

Question No 50 - (9700_s23_12_22)

One characteristic of DNA is that it is a universal genetic code.

What is meant by a universal genetic code?

- A** All living organisms use the same triplet code for amino acids.
B All DNA triplets code for a different amino acid.
C Not all DNA triplets code for an amino acid.
D All living organisms contain the same four nucleic acids.

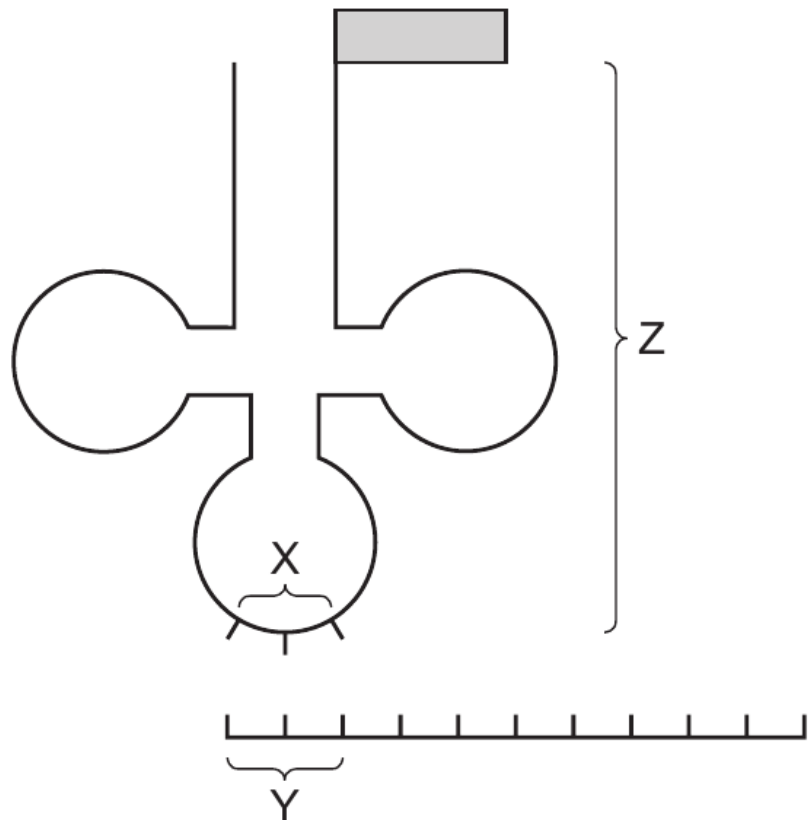
Question No 51 - (9700_s23_12_23)

Which statement about mRNA is correct?

- A** It is a polymer made of nucleotides all joined with hydrogen bonds.
- B** Each nucleotide subunit contains the sugar ribose.
- C** It always has an equal proportion of adenine and uracil.
- D** The mRNA sequence is identical to the template strand of DNA.

Question No 52 - (9700_s23_12_24)

The diagram shows part of the process of translation.



What are the names of the structures labelled X, Y and Z?

	X	Y	Z
A	anticodon	codon	mRNA
B	anticodon	codon	tRNA
C	codon	anticodon	mRNA
D	codon	anticodon	tRNA

Question No 53 - (9700_s23_12_25)

The DNA triplets of genes are translated as amino acids or stop signals during protein synthesis. The table shows some of these triplets.

DNA triplet	name of amino acid
ATA	tyrosine
ATG	tyrosine
ACA	cysteine
ACG	cysteine
ATC	<i>stop signal</i>
ACC	tryptophan

What could be the effects of **one** substitution mutation in a triplet coding for tyrosine?

- 1 The triplet is translated as cysteine.
- 2 The triplet is translated as tryptophan.
- 3 The triplet is translated as tyrosine.
- 4 Translation stops at this triplet.

A 1, 2 and 3 **B** 1, 2 and 4 **C** 1, 3 and 4 **D** 2, 3 and 4

Question No 54 - (9700_s23_11_19)

Which statement about messenger RNA is correct?

- A** In eukaryotic cells, mRNA is made by removing exons from the primary RNA transcript.
- B** mRNA is a single-stranded polynucleotide containing a different purine base than DNA.
- C** mRNA molecules contain ribose sugars joined to phosphate groups by phosphodiester bonds.
- D** The monomers of mRNA contain a phosphate group, deoxyribose sugar and a nitrogenous base.

Question No 55 - (9700_s23_11_20)

Which structures are involved in transcription only?

	DNA template strand	anticodons	RNA polymerase
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key

✓ = involved

✗ = not involved

Question No 56 - (9700_s23_11_21)

One gene provides the code for the production of which type of molecule?

- A** amino acid
- B** DNA
- C** nucleotide
- D** polypeptide

Question No 57 - (9700_s23_11_22)

The table shows some mRNA codons that code for certain amino acids.

mRNA codon	amino acid
GCG, GCA, GCC, GCU	alanine
ACG, ACA, ACC, ACU	threonine
UGC, UGU	cysteine
UAC, UAU	tyrosine
CAG, CAA	glutamine
CGG, CGA, CGC, CGU	arginine

A DNA template strand has the base sequence shown.

ACAGTATTATTTGCAACG

What would the change in the amino acid be if the first base in the fifth DNA triplet was substituted for an A base?

- A** alanine to cysteine
- B** alanine to threonine
- C** arginine to cysteine
- D** arginine to threonine

Question No 58 - (9700_m23_12_21)

DNA polymerase catalyses condensation reactions between molecules during semi-conservative replication of DNA.

What is joined by DNA polymerase?

- A** base and base
- B** base and nucleotide
- C** nucleotide and nucleotide
- D** phosphate and ribose

Question No 59 - (9700_m23_12_22)

Two polynucleotide strands make up a DNA molecule.

Which description is correct?

- A** The percentage of cytosine is 50% of that of guanine in the whole molecule.
- B** The percentage of cytosine is the same as that of guanine in the whole molecule.
- C** The percentage of cytosine is the same as that of guanine in each strand.
- D** The percentage of cytosine is the same in each strand of the molecule.

Question No 60 - (9700_m23_12_23)

The *PDx1* protein is found in a wide range of animal species where it is regarded as essential for normal metabolism. In sand rats, the gene coding for the *PDx1* protein has a much lower proportion of A and T nucleotides than *PDx1* genes from other animals.

Finding the complete DNA sequence of the *PDx1* gene in sand rats has been difficult. Sequencing involves splitting off nucleotides one at a time from single-stranded DNA.

What could account for the difficulty in finding the DNA sequence of the *PDx1* gene in sand rats?

- 1 The *PDx1* gene is present in only a small proportion of nuclei.
- 2 The *PDx1* gene is transcribed in only some cells.
- 3 The strength of the hydrogen bonding between the two strands of the *PDx1* gene is unusually high.

- A** 1, 2 and 3 **B** 1 only **C** 2 only **D** 3 only

Question No 61 - (9700_m23_12_24)

Different tissues in a plant were supplied with a radioactively labelled substance to identify which tissues were actively synthesising mRNA.

Which radioactively labelled substances would be suitable for this experiment?

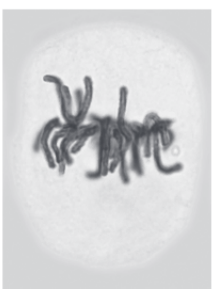
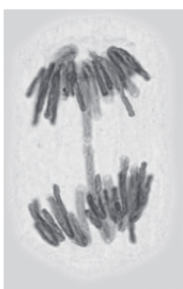
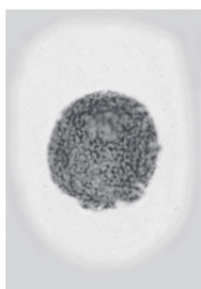
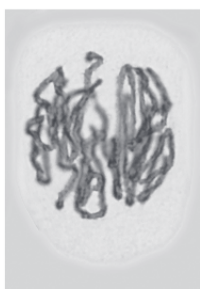
- 1 adenine
- 2 uracil
- 3 inorganic phosphate
- 4 ribose

- A** 1, 2, 3 and 4
- B** 1, 2 and 3 only
- C** 2 and 4 only
- D** 4 only

Question No 62 - (9700_w22_13_19)

9 The photomicrographs show cells in various stages of the cell cycle.

In which stage does semi-conservative replication of DNA take place?

A**B****C****D**

Question No 63 - (9700_w22_13_22)

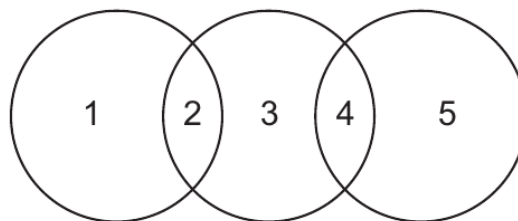
What does a nucleotide contain?

- 1 an amino acid
- 2 a codon
- 3 a nitrogenous base
- 4 a sugar

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

Question No 64 - (9700_w22_13_23)

A diagram can be used to show some relationships between different nucleic acid bases.



Which row is correct for the words that can be placed at positions 1–5?

	1	2	3	4	5
A	adenine	purine	cytosine	pairs with	guanine
B	cytosine	purine	guanine	pairs with	uracil
C	guanine	pairs with	cytosine	pyrimidine	thymine
D	thymine	pairs with	uracil	pyrimidine	adenine

Question No 65 - (9700_w22_13_24)

The bacterium *Escherichia coli* divides once every 50 minutes at 36 °C.

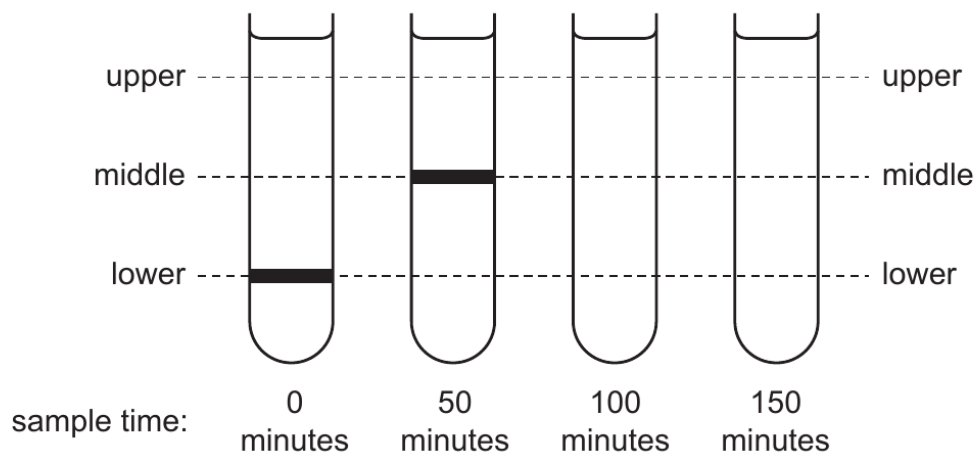
E. coli were grown on a medium containing only heavy nitrogen, ^{15}N , until all of the bacterial DNA contained heavy nitrogen.

Some of the bacteria were moved from a heavy nitrogen medium and cultured in a medium with only light nitrogen, ^{14}N (0 minutes).

These bacteria continued to reproduce and samples were extracted and centrifuged at regular intervals.

Hybrid DNA contains both heavy and light nitrogen.

The diagram shows the possible positions (upper, middle and lower) of the bands of DNA. The actual positions of bands in the first two samples are shown.



Which proportion of the DNA of the sample taken at 150 minutes will be at the upper position?

- A** 25% **B** 50% **C** 75% **D** 100%

Question No 66 - (9700_w22_13_25)

Following translation, the alpha polypeptide chain of haemoglobin, α -globin, undergoes modification. During this modification, the first amino acid is removed, leaving 141 amino acid residues.

How many nucleotides does the mRNA coding for α -globin contain?

- A** 141 **B** 142 **C** 423 **D** 426

Question No 67 - (9700_w22_12_20)

A gene codes for the production of a protein, p53, that binds to damaged DNA during interphase and prevents its replication. A carcinogen in cigarette smoke mutates the gene coding for the p53 protein, preventing production of the protein.

Which statement explains why this mutation may cause cancer?

- A** Cells with no p53 are able to undergo mitosis.
- B** Cells with no p53 replicate their damaged DNA.
- C** The carcinogen in cigarette smoke increases the rate of cell division.
- D** The mutated p53 causes uncontrolled cell division.

Question No 68 - (9700_w22_12_22)

How many statements about semi-conservative replication of DNA in a eukaryotic cell are correct?

- 1 The process takes place in the cytoplasm.
- 2 An adenine nucleotide will line up against uracil on the template strand.
- 3 Each daughter molecule will contain half of the original DNA molecule.
- 4 If the DNA molecule contained 40% guanine nucleotides, each daughter molecule will contain 20% guanine nucleotides.

- A** 1 **B** 2 **C** 3 **D** 4

Question No 69 - (9700_w22_12_23)

A section of the polypeptide coding for the haemoglobin β -chain contains the following amino acids.

– Pro – Glu – Glu –

Patients with sickle cell anaemia have mutated β -polypeptide chains. The section of the mutated polypeptide contains the following amino acids.

– Pro – Val – Glu –

The table shows the possible anticodons for Val.

amino acid	anticodon
Val	C A A
Val	C A G
Val	C A C
Val	C A U

What is the corresponding DNA triplet code for the substituted amino acid in the mutated polypeptide?

A G T T **B** G A C **C** C T C **D** C A T

Question No 70 - (9700_w22_12_24)

Which diagram correctly represents temporary hydrogen bonding during transcription?

A **B** **C** **D**

A ----- U C ----- G G ----- C T ----- U

Question No 71 - (9700_w22_12_25)

The diagram shows part of the DNA sequence of a gene and a mutated sequence of the same gene.

normal DNA sequence ...CCG GAT TAT TGC GAG AAA TGG CAT TCT AGG ...

mutated DNA sequence ...CCG GAT GTA TTG CGA GAA ATG CAT TCT AGG ...

What are possible effects of the mutated sequence?

- 1 the presence of mRNA stop codons, UAG, UAA or UGA
- 2 a change in the sequence of amino acids
- 3 a non-functional protein
- 4 ribosomes cannot translate the mRNA

A 1, 2 and 3 **B** 1, 3 and 4 **C** 1 and 4 only **D** 2 and 3 only

Question No 72 - (9700_w22_11_23)

DNA replication in bacteria was investigated. Bacteria were grown in a medium with only heavy nitrogen, ^{15}N , until all of the bacterial DNA was heavy.

These bacteria were moved from the heavy nitrogen medium and cultured in a medium with only light nitrogen, ^{14}N . This formed the first generation.

The bacteria continued to reproduce, and a sample of bacteria was collected from the second generation and the DNA analysed.

Hybrid DNA contains heavy and light DNA.

Which row is correct for the second generation?

	percentage of heavy DNA strands	percentage of hybrid DNA molecules
A	25	25
B	25	50
C	50	25
D	50	50

Question No 73 - (9700_w22_11_24)

The sequence shows the series of bases at the start of a gene.

TAC CGA CCA CCA CAA CCA CGA...

After transcription, the mRNA was translated via tRNA into a sequence of amino acids. When this part of the polypeptide was analysed, it was found to contain the amino acids in the table.

amino acid	number present
Ala	2
Gly	3
Met	1
Val	1

What is the sequence of amino acids in this part of the polypeptide?

- A** Met Ala Gly Ala Gly Gly Val
- B** Met Ala Gly Gly Val Gly Ala
- C** Met Gly Ala Ala Val Ala Gly
- D** Met Gly Ala Ala Gly Gly Val

Question No 74 - (9700_w22_11_25)

The table shows the mode of action of two antibacterial drugs that can affect the synthesis of proteins.

antibacterial drug	rifampicin	streptomycin
mode of action	binds to RNA polymerase	causes errors in translation

If bacteria are treated with the drugs rifampicin **and** streptomycin, what will be the immediate effects?

- 1 Transcription will stop but faulty proteins may continue to be synthesised.
- 2 If translation has started, proteins may be faulty.
- 3 Translation will be inhibited.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Question No 75 - (9700_s22_13_22)

Which statement about the transcription and translation of a gene is correct?

- A** The non-transcribed strand of DNA has a base sequence that is identical to the mRNA produced in transcription.
- B** The template strand of DNA has a base sequence that is identical to the mRNA produced in transcription.
- C** The non-transcribed strand of DNA has a base sequence that is complementary to the tRNA molecules required in translation.
- D** The template strand of DNA has a base sequence that is complementary to the tRNA molecules required in translation.

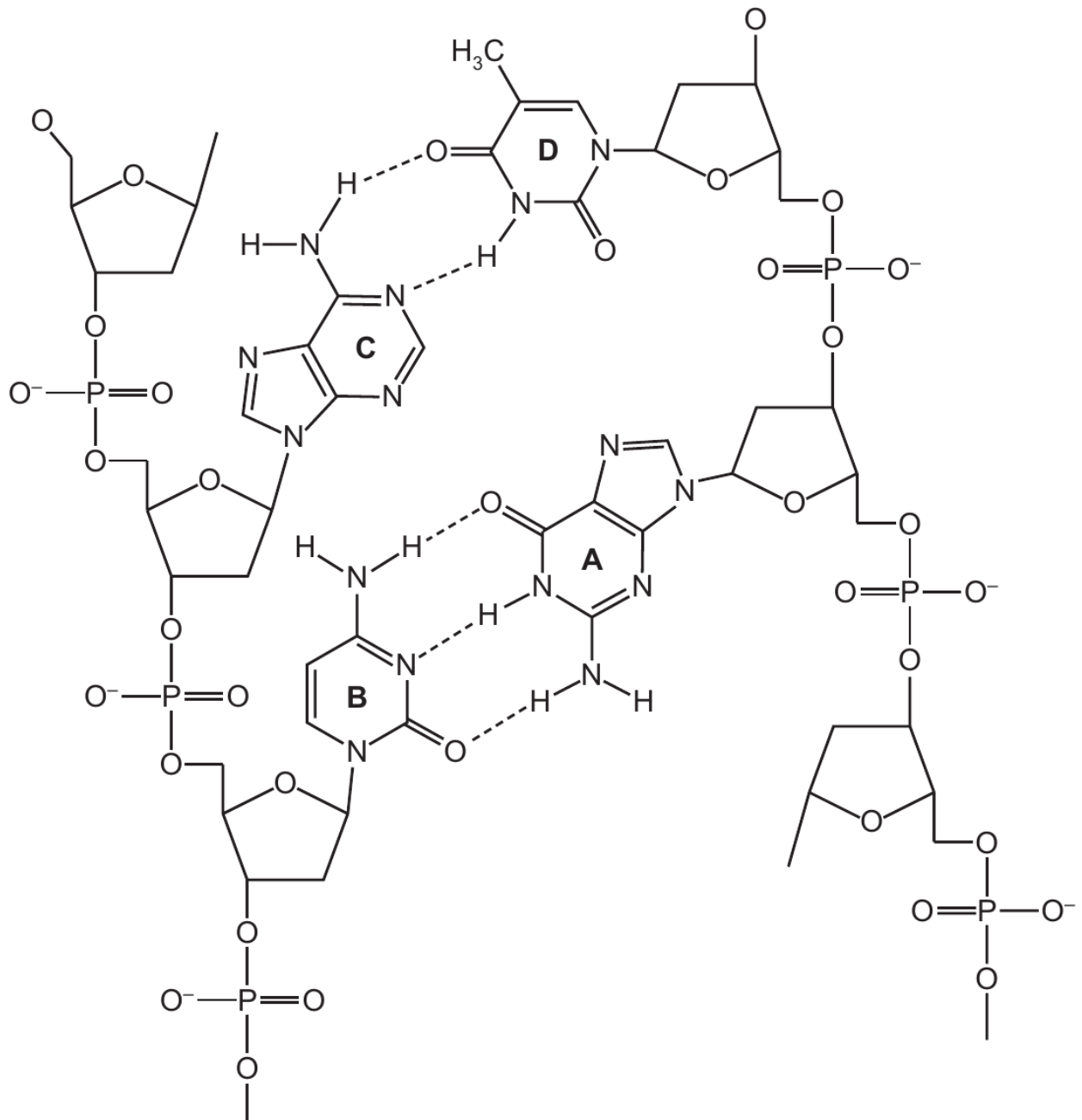
Question No 76 - (9700_s22_13_23)

Which statement about mRNA is correct?

- A** The primary transcript becomes modified by the joining of introns to become mRNA.
- B** The primary transcript is synthesised and then modified to mRNA in the nucleus.
- C** mRNA contains nucleotides containing the sugar deoxyribose.
- D** The bases in mRNA are held together by covalent bonds.

Question No 77 - (9700_s22_13_24)

The diagram shows part of a DNA molecule.



Which label is correct?

- A** adenine
- B** guanine
- C** cytosine
- D** thymine

Question No 78 - (9700_s22_13_25)

The sequence of bases in DNA coding for the first eight amino acids in the β -polypeptide of adult haemoglobin is:

CAC GTG GAC TGA GGA CTC CTC TTC

However, in haemoglobin C, which is a cause of haemolytic anaemia, it becomes:

CAC GTG GAC TGA GGA TTC CTC TTC

Some of the DNA triplets that code for the amino acids are listed in the table.

amino acid	DNA triplet
Glu	CTC
His	GTG
Leu	GAG
Lys	TTC
Pro	GGA
Thr	TGA

Which change occurs to the amino acid sequence of normal haemoglobin to make it haemoglobin C?

- A** Glutamic acid is changed to lysine.
- B** Histidine is changed to leucine.
- C** Leucine is changed to lysine.
- D** Proline is changed to threonine.

Question No 79 - (9700_s22_12_21)

Which statement describes the structure of ATP?

- A** It is a DNA nucleotide with two extra phosphates.
- B** It is a DNA nucleotide with three extra phosphates.
- C** It is an RNA nucleotide with two extra phosphates.
- D** It is an RNA nucleotide with three extra phosphates.

Question No 80 - (9700_s22_12_22)

Rifampicin is an antibiotic used to treat tuberculosis.

It works by inhibiting RNA polymerase in bacteria.

Which processes are directly inhibited by this antibiotic?

- 1 DNA replication
- 2 enzyme synthesis
- 3 ATP synthesis

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 only

Question No 81 - (9700_s22_12_23)

The table shows the DNA triplet codes for some amino acids.

amino acid	DNA triplet code	amino acid	DNA triplet code
arginine	GCA	glycine	CCA
arginine	GCC	glycine	CCG
arginine	GCG	glycine	CCT
asparagine	TTA	lysine	TTC
asparagine	TTG	lysine	TTT
cysteine	ACA	proline	GGA
cysteine	ACG	proline	GGC
STOP	ATC	valine	CAC

The base sequence on the template DNA strand coding for part of a polypeptide is shown.

CCA ACG GCG TTA TTC GCA

Two mutations occur in this sequence during DNA replication.

Which mutated template DNA strand would result in a shorter polypeptide?

- A** CCA ACA GCA TTA TTC GCA
- B** CCA ACG CCG TTA TTC GCC
- C** CCA ACG GCG TTG ATC GCA
- D** CCT ACG GCG TTA TTC GGA

Question No 82 - (9700_s22_11_20)

Telomerase is an enzyme that adds nucleotides to telomeres.

Which statement about telomerase is correct?

- A** A high concentration of telomerase in a cell damages genes during DNA replication.
- B** A high concentration of telomerase in cancerous cells limits the rate of tumour growth.
- C** The low concentration of telomerase in stem cells means that these cells can divide an unlimited number of times.
- D** The low concentration of telomerase in body cells means that these cells can divide a limited number of times.

Question No 83 - (9700_s22_11_22)

Bacterial cells with DNA containing only the 'heavy' isotope of nitrogen (^{15}N) are allowed to reproduce for three generations in a culture medium containing the normal isotope of nitrogen (^{14}N).

Which percentage of the DNA molecules produced contain strands with the heavy isotope of nitrogen?

	first generation %	second generation %	third generation %
A	50	25	12.5
B	75	50	25
C	100	50	25
D	100	75	50

Question No 84 - (9700_s22_11_23)

A bacterial circular DNA molecule is 2 600 150 base pairs long. 26% of the bases are adenine.

How many cytosine bases would be in the DNA molecule?

- A** 624 036 **B** 676 039 **C** 1 248 072 **D** 1 352 078

Question No 85 - (9700_s22_11_24)

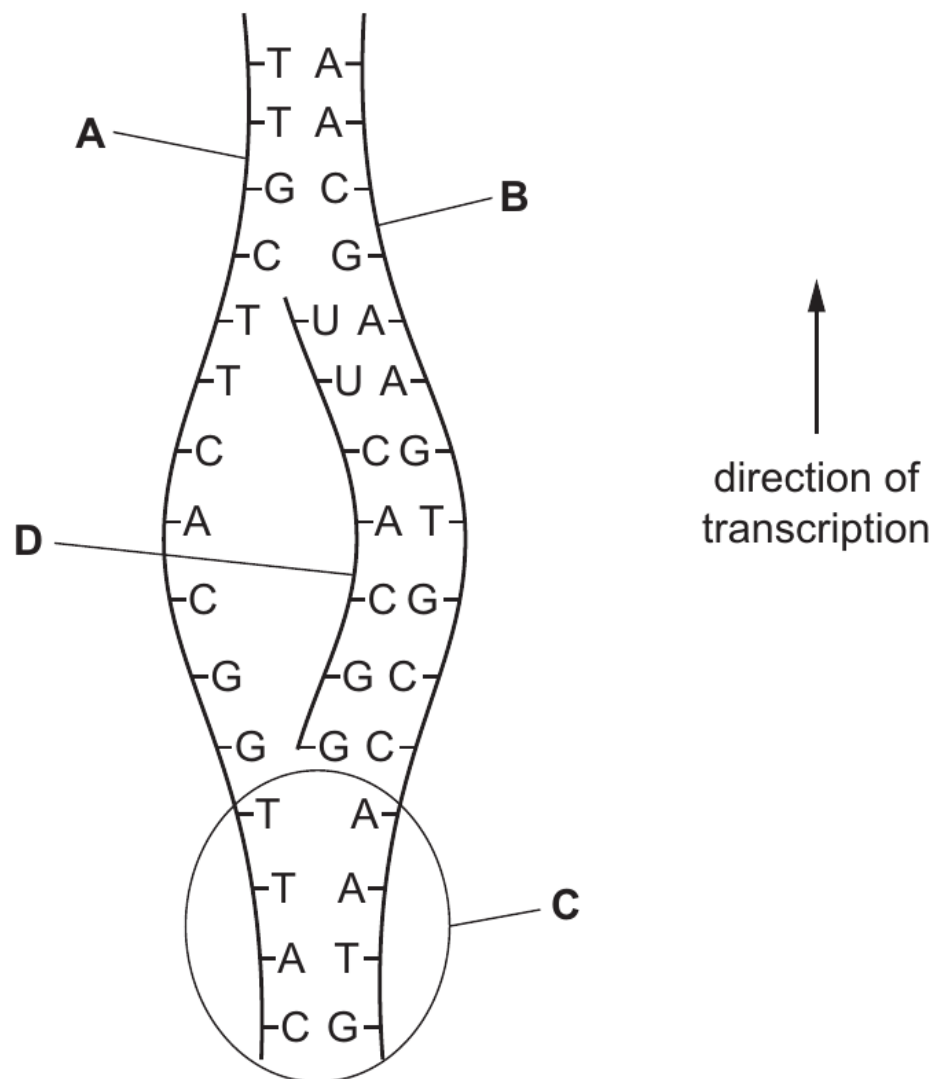
Which statement relating to the structure of DNA is correct?

- A** Two DNA strands are joined to each other by phosphodiester bonds.
- B** The alignment of bases to form a double helix is only achieved between antiparallel strands.
- C** Three hydrogen bonds are formed between all base pairs containing purines.
- D** The number of cytosine bases always equals the number of thymine bases.

Question No 86 - (9700_s22_11_25)

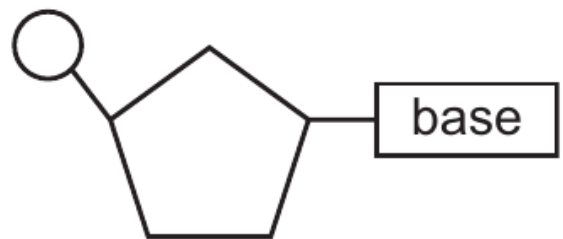
A student sketched a diagram to represent the process of transcription.

Which part of their diagram shows the non-transcribed strand?



Question No 87 - (9700_m22_12_23)

The diagram represents a nucleotide containing adenine.



Which statements about this nucleotide are correct?

- 1 The carbohydrate is a pentose.
- 2 The base contains nitrogen.
- 3 Base pairing occurs with uracil.
- 4 Adenine is a pyrimidine.

- A** 1, 2, 3 and 4
- B** 1, 2 and 3 only
- C** 1 and 2 only
- D** 3 and 4 only

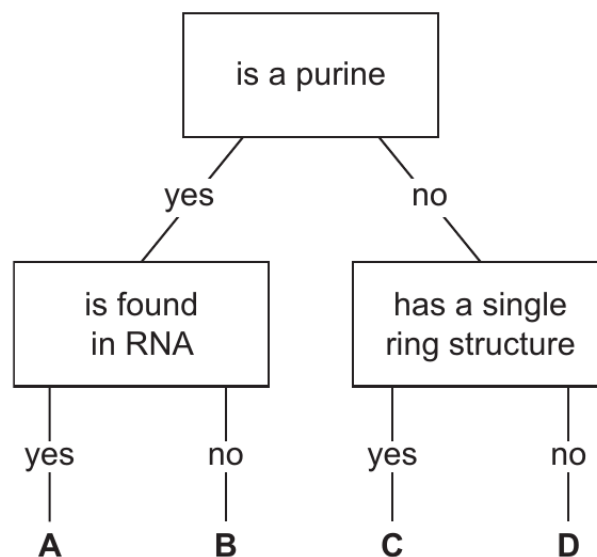
Question No 88 - (9700_m22_12_24)

Which row is correct for the replication of a DNA molecule?

	direction of DNA synthesis	enzyme that adds complementary nucleotides to lagging strand
A	3' to 5'	DNA polymerase
B	3' to 5'	DNA ligase
C	5' to 3'	DNA polymerase
D	5' to 3'	DNA ligase

Question No 89 - (9700_w21_13_21)

Which letter in the key describes uracil?



Question No 90 - (9700_w21_13_22)

When a gene for protease is activated, which nucleic acid will be formed?

- A** DNA
- B** mRNA
- C** rRNA
- D** tRNA

Question No 91 - (9700_w21_12_22)

A piece of a DNA molecule contains 84 base pairs. The table shows the number of adenine and cytosine bases in one or both of the DNA strands in this piece of DNA molecule.

base	strand 1	strand 2
adenine	28	23
cytosine	15	

How many guanine bases are present in this piece of DNA molecule?

- A** 18
- B** 33
- C** 36
- D** 41

Question No 92 - (9700_w21_12_23)

The mRNA sequences of the three stop codons are shown.

UAA UAG UGA

Which mutation in the template (transcribed) strand of a DNA sequence that codes for a polypeptide would cause translation to stop prematurely?

- A ATT changed to ATC
- B ACT changed to ACA
- C ACC changed to ATT
- D ATC changed to TAG

Question No 93 - (9700_w21_11_21)

Which statement helps to explain why the two sugar-phosphate chains in a DNA molecule are a constant distance apart?

- A Adenine and thymine are held together by the same number of hydrogen bonds as cytosine and guanine.
- B Each nucleotide molecule is the same size.
- C Each purine base is linked to a pyrimidine base.
- D The sugar-phosphate strands of the helix are held together by sulfur bridges.

Question No 94 - (9700_w21_11_22)

During DNA replication, what must happen **before** a newly added nucleotide is bonded to the next nucleotide in the strand?

- 1 complementary base pairing
- 2 hydrogen bond formation
- 3 phosphodiester bond formation

- A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only

Question No 95 - (9700_w21_11_23)

An antibiotic enters bacterial cells through a membrane channel protein, P.

Some bacterial cells have shown resistance to this antibiotic by acquiring a mutation which alters P. This mutation prevents the entry of the antibiotic into the cell.

Which conclusions can be drawn about how resistance to this antibiotic developed in these bacteria?

- 1 The mutation changed the order of the amino acids in the gene coding for P.
- 2 The mutation resulted in the production of P with an altered tertiary structure.
- 3 The antibiotic is a hydrophobic molecule and so cannot cross the phospholipid bilayer to enter the cell.

A 1, 2 and 3 **B** 1 and 3 only **C** 2 and 3 only **D** 2 only

Question No 96 - (9700_w21_11_24)

What is the correct tRNA anticodon coding for the amino acid proline?

amino acid	DNA triplet code on transcribed strand
alanine	CGT
histidine	GTG
proline	GGT

A CCA **B** CCU **C** GGT **D** GGU

Question No 97 - (9700_s21_13_19)

Hydra are simple animals which can reproduce asexually.

The photomicrograph shows an adult hydra with a new hydra developing while attached to the side of the adult animal.



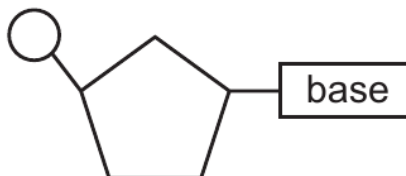
Which processes have occurred in the two hydra?

- 1 DNA replication
- 2 growth
- 3 mitosis

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Question No 98 - (9700_s21_13_20)

The diagram represents a nucleotide containing thymine.



Which statements about this nucleotide are correct?

- 1 Thymine is a pyrimidine.
- 2 Base pairing occurs with two hydrogen bonds.
- 3 The carbohydrate can be ribose or deoxyribose.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Question No 99 - (9700_s21_13_21)

Some of the events that occur during transcription are listed.

- 1 Bonds break between complementary bases.
- 2 Bonds form between complementary bases.
- 3 Sugar-phosphate bonds form.
- 4 Free nucleotides pair with complementary nucleotides.

Before the mRNA molecule leaves the nucleus, which events occur twice during transcription?

A 1, 2 and 3 **B** 1, 3 and 4 **C** 2, 3 and 4 **D** 1 and 2 only

Question No 100 - (9700_s21_13_22)

The table shows the DNA triplet codes for some amino acids.

amino acid	DNA triplet code	amino acid	DNA triplet code
arginine	GCA	glycine	CCA
arginine	GCC	glycine	CCG
arginine	GCG	glycine	CCT
asparagine	TTA	lysine	TTC
asparagine	TTG	lysine	TTT
cysteine	ACA	proline	GGA
cysteine	ACG	proline	GGC
STOP	ATC	valine	CAC

The base sequence on the DNA template strand coding for part of a polypeptide is shown.

CCA TTC ACG GCG TTA GCA

Two mutations occur in this sequence during DNA replication.

Which mutated DNA would result in a polypeptide with one different amino acid?

- A** CCA ATC ACG GCG TTG GCA
- B** CCA TTC ACA GCA TTA GCA
- C** CCA TTC ACG CCG TTA GCC
- D** CCT TTC ACG GCG TTA GCC

Correct Answers for MCQs

Question 1 (9700_w24_13_21) : D
Question 2 (9700_w24_13_22) : A
Question 3 (9700_w24_13_23) : D
Question 4 (9700_w24_13_24) : B
Question 5 (9700_w24_13_25) : D
Question 6 (9700_w24_12_22) : B
Question 7 (9700_w24_12_23) : D
Question 8 (9700_w24_12_24) : C
Question 9 (9700_w24_12_25) : C
Question 10 (9700_w24_11_2) : D
Question 11 (9700_w24_11_23) : D
Question 12 (9700_w24_11_25) : C
Question 13 (9700_w24_11_26) : B
Question 14 (9700_w24_11_4) : C
Question 15 (9700_w24_11_5) : B
Question 16 (9700_m16_12_19) : C
Question 17 (9700_m16_12_20) : B
Question 18 (9700_m16_12_21) : D
Question 19 (9700_s24_13_19) : A
Question 20 (9700_s24_13_21) : D
Question 21 (9700_s24_13_22) : D
Question 22 (9700_s24_13_23) : C
Question 23 (9700_s24_13_24) : C
Question 24 (9700_s24_12_21) : B
Question 25 (9700_s24_12_22) : D
Question 26 (9700_s24_12_23) : B
Question 27 (9700_s24_11_21) : C
Question 28 (9700_s24_11_22) : B
Question 29 (9700_s24_11_23) : D
Question 30 (9700_m24_12_23) : A
Question 31 (9700_m24_12_24) : D
Question 32 (9700_m24_12_25) : B
Question 33 (9700_m24_12_26) : A
Question 34 (9700_m24_12_27) : A
Question 35 (9700_w23_13_22) : D
Question 36 (9700_w23_13_23) : B

Question 37 (9700_w23_13_24) : D
Question 38 (9700_w23_12_21) : C
Question 39 (9700_w23_12_22) : C
Question 40 (9700_w23_12_23) : C
Question 41 (9700_w23_11_20) : A
Question 42 (9700_w23_11_22) : D
Question 43 (9700_w23_11_23) : B
Question 44 (9700_w23_11_24) : D
Question 45 (9700_w23_11_25) : A
Question 46 (9700_s23_13_23) : C
Question 47 (9700_s23_13_24) : B
Question 48 (9700_s23_13_25) : D
Question 49 (9700_s23_13_26) : C
Question 50 (9700_s23_12_22) : A
Question 51 (9700_s23_12_23) : B
Question 52 (9700_s23_12_24) : B
Question 53 (9700_s23_12_25) : C
Question 54 (9700_s23_11_19) : C
Question 55 (9700_s23_11_20) : B
Question 56 (9700_s23_11_21) : D
Question 57 (9700_s23_11_22) : C
Question 58 (9700_m23_12_21) : C
Question 59 (9700_m23_12_22) : B
Question 60 (9700_m23_12_23) : D
Question 61 (9700_m23_12_24) : C
Question 62 (9700_w22_13_19) : C
Question 63 (9700_w22_13_22) : D
Question 64 (9700_w22_13_23) : C
Question 65 (9700_w22_13_24) : C
Question 66 (9700_w22_13_25) : D
Question 67 (9700_w22_12_20) : B
Question 68 (9700_w22_12_22) : A
Question 69 (9700_w22_12_23) : D
Question 70 (9700_w22_12_24) : B
Question 71 (9700_w22_12_25) : D
Question 72 (9700_w22_11_23) : B
Question 73 (9700_w22_11_24) : B
Question 74 (9700_w22_11_25) : B

Question 75 (9700_s22_13_22) : C
Question 76 (9700_s22_13_23) : B
Question 77 (9700_s22_13_24) : D
Question 78 (9700_s22_13_25) : A
Question 79 (9700_s22_12_21) : C
Question 80 (9700_s22_12_22) : D
Question 81 (9700_s22_12_23) : C
Question 82 (9700_s22_11_20) : D
Question 83 (9700_s22_11_22) : C
Question 84 (9700_s22_11_23) : C
Question 85 (9700_s22_11_24) : B
Question 86 (9700_s22_11_25) : A
Question 87 (9700_m22_12_23) : B
Question 88 (9700_m22_12_24) : C
Question 89 (9700_w21_13_21) : C
Question 90 (9700_w21_13_22) : B
Question 91 (9700_w21_12_22) : B
Question 92 (9700_w21_12_23) : C
Question 93 (9700_w21_11_21) : C
Question 94 (9700_w21_11_22) : B
Question 95 (9700_w21_11_23) : D
Question 96 (9700_w21_11_24) : D
Question 97 (9700_s21_13_19) : A
Question 98 (9700_s21_13_20) : B
Question 99 (9700_s21_13_21) : D
Question 100 (9700_s21_13_22) : C